DEPARTMENT OF THE ARMY

US ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY

ABERDEEN PROVING GROUND, MARYLAND 21010-5401

REPLY TO ATTENTION OF

30098841

Superfund

CETHA-IR-A (50-6c)

6 SEP 1989

MEMORANDUM FOR Commander, U.S. Army Engineer Center and Fort Leonard Wood
ATTN: ATZT-DEH, Fort Leonard Wood, MO 65473-5000

SUBJECT: St. Louis Ordnance Plant, Buildings 219A, D and G

1. This memorandum is in response to verbal requests by your staff for information on decontamination and use of warehouse buildings numbered 219A, 219D and 219G. These buildings are located at the Hanley Area of the St. Louis Ordnance Plant (SLOP), St. Louis, Missouri. We understand that they are needed for dry, nontemperature controlled storage.

2. The historical usage of the buildings was determined and the potential contaminants evaluated in 1980 by this Agency. This information is contained in our report "Survey of Hazardous/Chemical Area No. 2 of the Former St. Louis Ordnance Plant", No. 109, dated January 1981. Selected pages from this report, pertaining to these three buildings, are enclosed at enclosure 1. The building interior surfaces are contaminated with low levels of lead, silver, nickel, chromium, cadmium and mercury.

3. Recent efforts by this Agency and your staff to further characterize the condition of these buildings reveal the following. Tests for Extraction Procedure Toxicity - Metals shows that the red colored nonsparking flooring that was installed during the 1940s is not a hazardous waste based on metals content. A separate test for lead content was also conducted. Results of these analyses are provided at enclosure 2. Recent tests conducted by ICF Technology Inc. for this Agency show that the flooring is however, an asbestos containing material (ACM). A sample of the flooring was analyzed by polarized light microscopy with dispersion staining (PLM-DS), and found to contain 1-5% chrysotile. Inspection of the utility access space and tunnels under the buildings, and testing of pipe insulation, disclosed heating pipes also covered with ACM. This asbestos does not carry into the main floor storage space of the buildings. The ceilings are insulated with a fiberglass type material.

4. As part of the initial assessment of contamination at SLOP, ICF Technology, Inc., the Government's RI/FS contractor, has developed a worst-case assessment of potential risk associated with occasional usage of Bldgs. 219A, D, and G. This assessment is included as part of the work plan for the SLOP RI/FS and pertinent sections are included at enclosure 3.

5. Any work on the three buildings to improve their condition must take into consideration the following contaminants and decontamination requirements. The flooring is an ACM in poor condition due to unprotected exposure to rain, freezing, etc. It must be removed and disposed of in accordance with state and Federal asbestos and related regulations. Work on the heating pipes, especially those in the utility space under the building, must consider the presence of asbestos. If any asbestos is removed while working on the radiators or pipes,

ATZT-DEH-EE 18 September 1989

MEMORANDUM FOR Off Post Facilities, ATTN: Ed Rothwell

Subject: Buildings 219A, D, and G at St. Louis Ordnance Plant

1. The US Army Toxic and Hazardous Materials Agency has finished an investigation of the subject buildings at St. Louis Ordnance Plant (enclosed).

2. The report indicates that the contamination in these buildings consists of heavy metal residues on the walls and asbestos in the flooring material. The residue on the walls can be washed off and the flooring materials removed, allowing use of the buildings for virtually any purpose.

3. The wash water from decontamination of the walls would probably be a hazardous waste, requiring special disposal. This water should be caught after this process and disposed of through a licensed hazardous waste Treatment, Storage, and Disposal Facility. Standard asbestos removal procedures should be adequate for the floor.

encl

Scott Murrell
SCOTT MURRELL
Environmental Coordinator

FRANK

See letter 14 Dec 89

See me on developing specifications.

Rothwell

6 SEP 1989

it must also be done in accordance with regulations. Respiratory protection and appropriate protective clothing must be used to comply with regulations. The ceiling insulation is fiberglass. Respiratory protection is recommended while removing the ceilings and insulation.

6. The interior glazed tile walls are soiled to touch, and have been shown to possess the contaminants reported in enclosure 1. It is therefore recommended that the walls be completely and thoroughly cleaned with a detergent solution and rinsed with clean water. Protective clothing to prevent skin contact with the contaminants is recommended.

7. After these decontamination procedures, involving ceiling, walls and flooring, are completed, renovation work may proceed using normal procedures and practices. Use of the buildings should be restricted to non-consumables storage.

8. Point of contact at this Agency is Mr. Darryl D. Borrelli, AUTOVON 584-3921 or commercially (301) 671-3921.

FOR THE COMMANDER:

3 encls
as

ROBERT S. METZGER II
LTC, CM
Deputy
Installation Restoration Division

SURVEY OF HAZARDOUS/CHEMICAL AREA NO. 2

OF THE FORMER ST. LOUIS ORDNANCE PLANT

REPORT NO.

VOLUME I

JANUARY 1981

US ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY

ABERDEEN PROVING GROUND, MD 21010

ENCL 1

EXECUTIVE SUMMARY

The Hazardous/Chemical Area No. 2 of the former St. Louis Ordnance Plant was surveyed for explosive and heavy metal contamination. This area was occupied by the Goodfellow US Army Reserve Center (GUSARC) from 1960-1977 for Army Reserve Operations and Training and Hanley Industries, Inc. (Hanley) from 1959-1979 for the manufacturing of explosive and pyrotechnic devices. The Department of Labor (DOL) desired both the GUSARC and the Hanley areas for the site of a Job Corps Center. The DOL had need for the earliest possible use of the GUSARC area, therefore, the USATHAMA survey of Hazardous/Chemical Area No. 2 was conducted in two phases: Phase I was the survey of the GUSARC and Phase II was the survey of the Hanley area.

The findings of the GUSARC area survey (conducted Jan-May 79) revealed the presence of heavy metal residues on the interior surfaces of many buildings as well as the presence of explosive residues in the floor drains of four buildings. This information was transmitted to DOL in Jun 79 to provide guidance for their renovation and demolition activities in the GUSARC area.

The findings of the Hanley area survey (conducted Aug-Nov 80) showed heavy metal residues to be present on the interior surfaces of all buildings and in the aqueous discharge of the sewer system. Additionally, explosive residues were found on the building interiors of thirteen buildings and in the water sampled in seven powder wells (sumps) draining two buildings. It is recommended that the 13 buildings and seven powder wells found to contain explosive residues be decontaminated. Additionally, it is recommended that monitoring of the air in the buildings as well as the aqueous discharge of the sewers be conducted subsequent to the renovation and demolition activity proposed to be conducted in the Hanley Area.

Table 2

Hanley Industries

Potential Contaminants

2,4,6-Trinitrotoluene (TNT)

2,4- and 2,6-Dinitrotoluene (DNT)

2,4,6-Trinitrophenylmethylnitramine (Tetryl)

2,4,6-Trinitroresorcinol (Styphnic Acid)

Cyclotetramethylenetetranitramine (HMX)

Pentaerythrite Tetranitrate (PETN)

Lead Styphnate (Lead Salt of Styphnic Acid)

Tetrazene (TETR)

Nitroglycerine (NG)

Nitrocellulose (NC)

Lead (Pb)

Silver (Ag)

Nickel (Ni)

Mercury (Hg)

Chromium (Cr)

Cadmium (Cd)

Table 3

Hanley Industries

Areas of Potential Contamination

	Building/Magazine	Area
HIGH POTENTIAL	220	All rooms
	218	15 rooms
	218B	12 rooms
	218C	1 room and basement
	219A	All rooms
	219C, E, J, H	Throughout
	219G	Throughout
	227B, L, P, Q	Throughout
	226C, G	Throughout
	229M	Throughout
	Powder wells	Throughout
	Sewer lines	Throughout
MODERATE POTENTIAL	2270, N, M, K, J. H, G, F, E, D, C, A	Throughout
	226H, F, E, D, B, A	Throughout
	229L, N, H, J, K	Throughout
LOW POTENTIAL	227T	
	228 Series	
	Soil	
	Soils	
	Pipe Tunnels	
	Crawl Spaces	

Table 5

Hanley Industries

Explosive Components Loaded for the Military, NASA, and NATO

Delay cartridges
Leads
Detonators
Primers (electric and delay)
Squibs
Explosive Bolts
Activators
Bomb Initiators
Spotting charges
Boosters

Table 6

Hanley Industries

Buildings/Magazines in Which Loading and Mixing of

Explosives were Conducted

Bldg	Room
220	All rooms except basement
218A	102, 104, 105, 106, 107, 108. 109, 110, 111, 112, 113, 117, 121, 123. Delay powder loaded in basement under Room 105.
218B	110, 113, 115, 119, 123, 125, 127, 128-1, 128-2, 128-3, 128-4, 132
218C	104
219A	Loading of smokeless powder throughout.

Table 7

Hanley Industries

Building Usage

Other Than for Loading and Mixing of Explosives (Table 6)

Bldg	Area	Usage
218A	All rooms not listed on Table 4	Non-explosive storage
218B	Basement	Empty as non-explosive storage
218C	Basement	Burning of explosive contaminated rags
219D		Never used
219G		One time loading of explosives for disposal
219C, B, F, J & H		Drying of explosives
219E		Lead azide reactor
All Other magazines		Storage of explosives in sealed containers
219A		Administrative

Table 8

Hanley Industries

Compounds Utilized

Lead Styphnate

Tetryl (2,4,6-Trinitrophenylmethylnitramine)

RDX

NOL 130 (Ignition mix)

A180 (Ignition mix)

Black Powder

HMX (Cyclotetramethylenetetranitramine)

NOL 60 (Ignition mix)

PETN (Pentaerythrite Tetranitrate)

Tetracene

Silver azide

Smokeless powder

Trinitroresorcinol

Diazodinitrophenol

Delay powder

Lead nitrate

Sodium azide

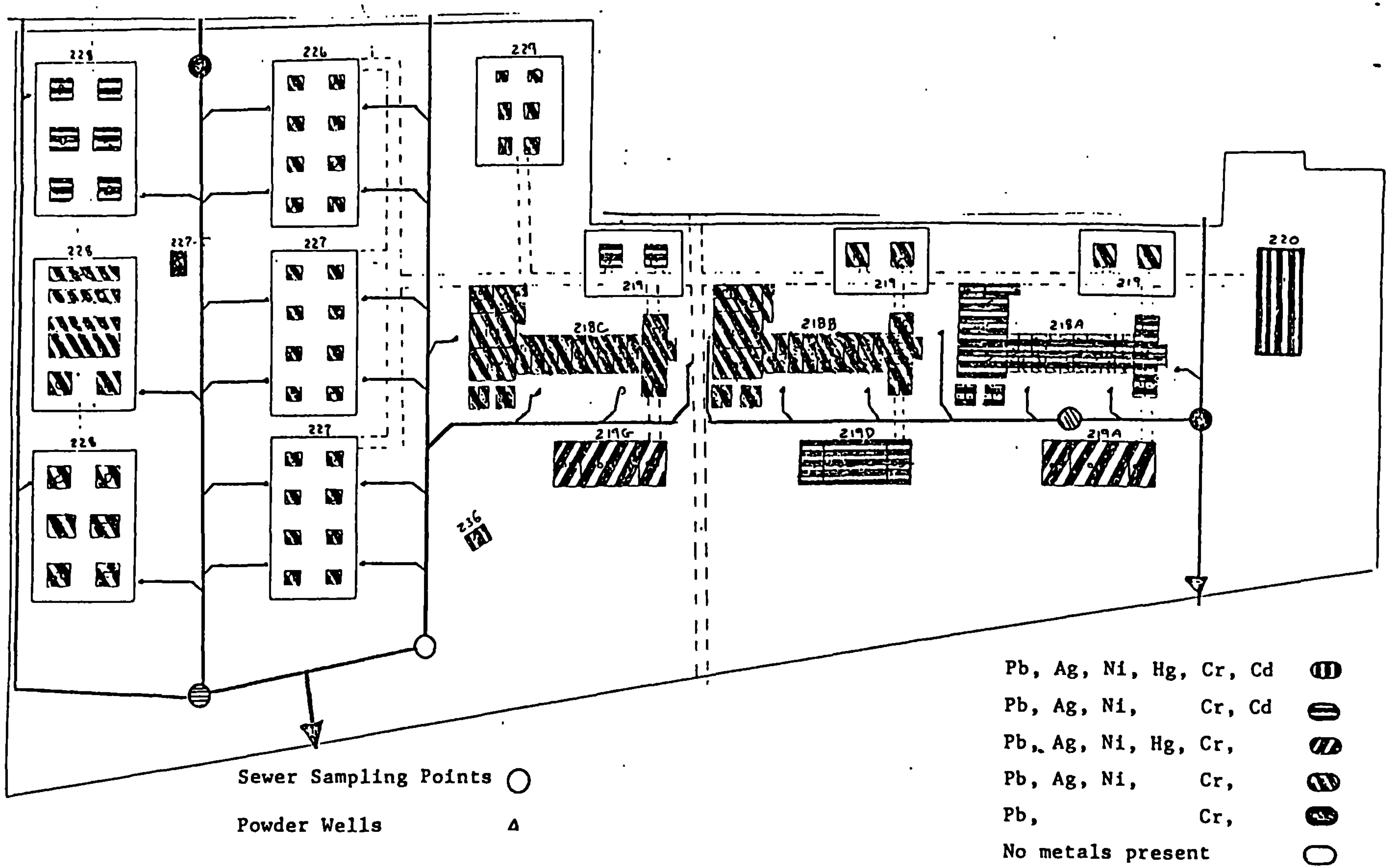

Figure 8. Hanley Area Facilities Contaminated with Heavy Metal Residues

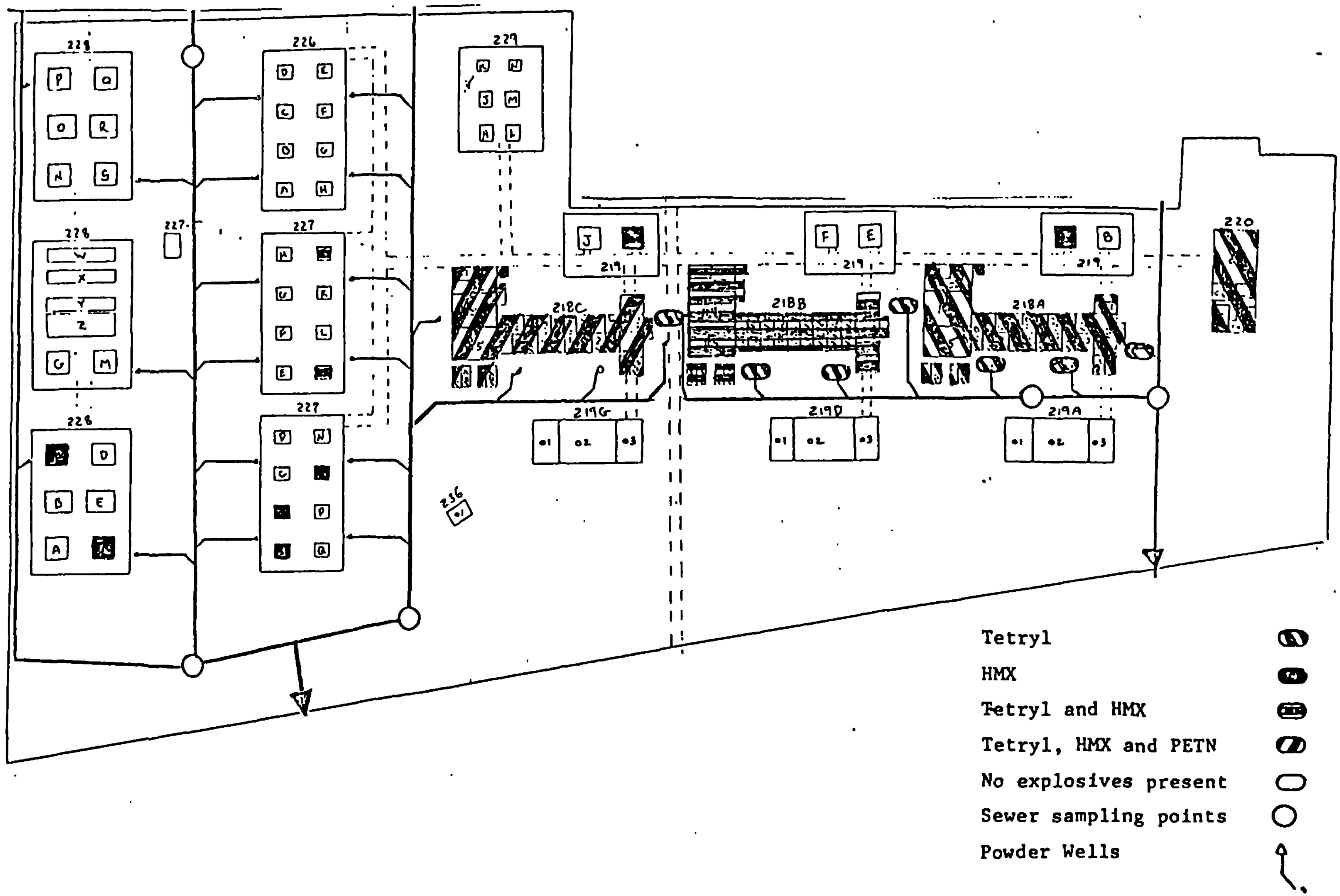

Figure 9. Hanley Area Facilities Contaminated with Explosive Residues

The shaded areas shown on Figure 8 indicate the first floor rooms in which positive results were obtained for tetryl, above the 1 ug/cm^2 level. The composite sample taken in the basement of building 218C showed a positive result for PETN which indicates this explosive is present above the detection limit of 1 ug/cm^2.

Water samples from the powder wells were composited into nine samples by building or magazine group (maximum of four samples per composite). Explosive compounds were not found in any of the powder well samples above detectable limits of 2.4 ppb. Composite samples from the powder wells which received effluent from buildings 218A and 218B contained 4.0 and 4.6 ppb of tetryl, respectively.

None of the sewer samples contained explosive compounds in concentrations above the detection.

VII. CONCLUSIONS.

A. Goodfellow US Army Reserve Center.

1. Heavy Metal Residues. As tabulated on Table 12 and shown on Fig. 6 heavy metal residues are present on the walls of 27 buildings and magazines. Due to the lack of information concerning building usage the correlation between building usage and survey findings is untenable. It was concluded that the heavy metal residues found in the buildings of the GUSARC posed an ingestion hazard.

2. Explosive Residues. Four magazines were found to contain explosive residues in the floor drains. It was concluded that these residues did not present a safety hazard.

B. The Hanley Area.

1. Heavy Metal Residues. As tabulated on Table 13 and shown on Fig. 8 heavy metal residues were found on all building and magazine interior surfaces

Table 13

Hanley Area

Summary of Findings

Building/Magazine	Findings
220	Records and Interviews: a) Use for administrative space (1941-1945); b) Decontaminated in 1945; c) Explosive laboratory (1959-1979). Survey: Explosive and heavy metal residues present.
218A, B and C	Records and Interviews: a) Primers and tracer mixing (1941-1945); b) Decontaminated in 1945; c) Loading and mixing of explosives (1959-1979). Survey: Explosive and heavy metal residues present in buildings. Explosive residues present in powder wells draining 218A and B.
219A, D and G	Records and Interviews: a) Primer and tracer mixing (1941-1945); b) Decontaminated in 1945; c) Loading of smokeless powder (219A) and administrative space (219D and G) from 1959-1979. Survey: Heavy metal residues present.
236	Records and Interviews: a) Used as a garage 1941-1945; b) 1945-1979 not used. Survey: Heavy metal residues present.
219C and H	Records and Interviews: a) Decontaminated in 1945; b) Open air drying of explosives (1959-1979). Survey: Explosive and heavy metal residues present.
219E	Records and Interviews: a) Decontaminated in 1945; b) Lead azide production (1959-1979). Survey: Heavy metal residues present.
219B, F and J	Records and Interviews: a) Decontaminated in 1945; b) Open air drying of explosives (1959-1979). Survey: Heavy metal residues present.
229 Series	Records and Interviews: a) Decontaminated in 1945; b) Storage of explosive and items (1959-1979). Survey: Heavy metal residues present.
226 Series	Records and Interviews: a) Explosive mixing operations (1941-1945); b) Decontaminated in 1945; c) Storage of explosives in sealed containers (1959-1979). Survey: Heavy metal residues present.

Table 13 (Continued)

Building/Magazine	Findings
227 Series	Records and Interviews: a) Explosive mixing operations (1941-1945); b) Decontaminated in 1945; c) Storage of explosives in sealed containers (1959-1979). Survey: Heavy metal residues present in all magazines. Explosive residues present in 227A, 227B, 227J, 227M and 227O.
227T	Records and Interviews: a) Administrative space (1941-1945); b) Abandoned 1945-1979. Survey: Heavy metal residues present.
228 Series	Records and Interviews: a) Powder storage (1941-1945); b) Decontaminated in 1945; c) Abandoned from 1945-1979. Survey: Heavy metal residues present in all magazines. Explosive residues present in 228C and 228F.

and in the discharge of the sewers. Based on the worst case air concentration estimation model (described at IIIC1) an inhalation hazard may be encountered should the residues become airborne. Additionally, an ingestion hazard exists due to the presence of the heavy metal residues on the building/magazine surfaces. If the discharge standards, for heavy metals, of the City of St. Louis is not being exceeded, the heavy metal concentrations found in the sewer lines do not present a problem.

2. Explosive Residues.

a. Explosives.

Explosive residues are present in buildings 218A, 218B, 218C and 220 as well as in magazines 219C, 219H, 227A, 227B, 227J, 227M, 227O, 228C and 228F. The residues were found on the walls, therefore, it is unknown whether or not explosive residues have accumulated in the drop ceilings or within the walls (many of which are constructed of hollow tile) or in parts of rooms which were not sampled.

The presence of tetryl in the 218 buildings as well as in the powder wells draining 218A and 218B leads further to the conclusion that the drain lines from the buildings to the powder wells also contain explosives, at least tetryl.

Hanley stored explosive to be used in manufacturing operations in several magazines, therefore, explosive residues are understandably present in magazines in the 227 series. Building 220 was an explosive laboratory and loading and mixing of explosives was conducted by Hanley in buildings 218A, 218B and 218C. Magazines in the 219 series were used by Hanley for open air drying of explosives which explains the presence of explosives in 219C and 219H. Therefore, the positive results obtained in these buildings and magazines coincide with the historic use of the buildings.

Building 227T was used for administrative purposes only and building 219A was used for the loading of smokeless powder. Building 236 was a garage and as such this building would also be expected to be free of explosive contamination. Buildings 219D and 219G also were not used for any explosive related operations. The magazines other than those in the 219 series and in the 227E-M group were supposedly used by Hanley for the storage for shipment of explosive end items and consequently the lack of explosive residues in these structures is understandable. Magazine 219E once housed Hanley's lead azide reactor.

Two inconsistencies exist between the use of history of the facilities in the Hanley area and the results of the survey. The first is that Hanley reportedly did not use the magazines in the 228 series (which were decontaminated in 1945) yet trace amounts of HMX were detected in magazines 228C and 228F and in no other magazines in 228 series (including the explosive drying ovens). The second is that explosive residues were found in the powder wells draining buildings 218A and 218B and Hanley, reportedly, never used the drain lines or powder wells in the leased area. The only explanation for these inconsistencies is that the decontamination of these structures at the close of World War II was not complete.

It is concluded that explosive residues are present on and quite possibly within the walls of 13 buildings and magazines in the Hanley area as well as in seven powder wells. Explosive residues are not present in the sewer lines draining the Hanley Area.

VIII. RECOMMENDATIONS.

A. Goodfellow US Army Reserve Center. Since there were no standards for the types of contamination found at the GUSARC, it was recommended that the DOL (who would be decontaminating the area during renovation and demolition) take the precautions listed at III.E.1. Additionally, it was recommended that the discharge in the sewer system be sampled and analyzed to ensure compliance with the discharge standards of the City of St. Louis.

B. Hanley Area.

If buildings 218A, 218B, 218C and 220 and magazines 219C, 219H, 227A, 227B, 227J, 227M, 227O, 228C and 228F are to be used for any purpose other than explosive production or manufacturing, they will have to be decontaminated. Decontamination of the entire building is necessary as many walls in these buildings are constructed of hollow tiles wherein dust may have accumulated. Additionally, although only a few rooms in each building were found to contain explosive residues, the likelihood of contamination in the other rooms was confirmed when several glazed tiles were shattered (to observe their construction) resulting in the ignition and burning of residues on the walls of the rooms in which explosive residues were not found to be present. Accordingly, it is recommended that buildings 218A, 218B, 218C and 220 as well as magazines 219C, 219H, 227A, 227B, 227J, 227M, 227O, 228C and 228F be flashed which would ultimately result in the demolition of the structures.

Due to the presence of Tetryl in the powder wells draining buildings 118A and 218B, it is recommended that these powder wells be drained and flahsed and that the drain lines leading to the powder wells be removed and flashed.

It is recommended that air monitoring for heavy metals and asbestos (due to the age of the structures and the presence of insulation on steam lines) be conducted during and at the end of renovation and/or demolition activities to ensure compliance with occupational safety and health administration standards. Additionally, building/magazine interior surfaces should be resampled at the conclusion of renovation activities to ensure that a hazard does not exist from the ingestion of the residues on the surfaces of the structures.

To ensure compliance with the discharge standards of the City of St. Louis, it is recommended that the liquid discharge in the sewer system be sampled and analyzed.

metaTRACE, Inc. 13715 Rider Trail North • Earth City. MO 63045 • (314) 298-8566

June 14, 1989

Karl J. Daubel
Environmental Coordinator
Weldon Spring Training Area

Dear Sir:

Attached are the analytical results for the E.P. Toxicity and Total Lead testing on the sample identified as SLOP9.

Also, you will find the invoice for the testing.

If you do have any questions, please call.

Thank you,

Jerry A. Everett

Jerry Everett

ENCL 2

metaTRACE, Inc. 13715 Rider Trail North • Earth City, MO 63045 • (314) 298-8566

SAMPLE I.D.	METHOD	SLOP 9	BLANK
metaTRACE I.D.		AA29312	
DATE ANALYZED		6-1-89	6-1-89
DILUTION FACTOR		----	----
UNITS		UG/L	UG/L
METALS-E.P.TOX.			
ARSENIC	ICP	< 91	< 91
BARIUM	ICP	134	< 3
CADMIUM	ICP	< 4	< 4
CHROMIUM	ICP	< 7	< 7
LEAD	ICP	800	< 68
MERCURY	CVAA	< 0.2000	< 0.2000
SELENIUM	ICP	< 85	< 85
SILVER	ICP	< 10	< 10

metaTRACE, Inc. 13715 Rider Trail North • Earth City, MO 63045 • (314) 298-8566

SAMPLE I.D.	METHOD	SLOP 9	BLANK
metaTRACE I.D.		8A29312	
DATE ANALYZED		6-1-89	6-1-89
DILUTION FACTOR		----	----
UNITS		UG/G	UG/G
METALS-TOTAL			
LEAD	ICP	170	< 68

3.0 RISK ASSESSMENT PLAN

In this section, potential human health and environmental impacts associated with the SLOP site (Hanley Area) are preliminarily evaluated and the proposed approach and scope of the risk assessment to be conducted as part of the remedial investigation (RI) are outlined. The preliminary risk assessment presented in Section 3.1 is based on data collected during past sampling activities and is conducted to preliminarily identify potential risk at the site in the absence of remedial action or any demolition or renovation activities at the site. Potential risks identified in the preliminary risk assessment will be investigated more completely during the RI risk assessment. The proposed approach and scope of the RI risk assessment is outlined in Section 3.2.

3.1 PRELIMINARY RISK ASSESSMENT

As described in earlier sections of this work plan, past production operations have resulted in metal and explosives contamination in the Hanley Area of SLOP. During surveys conducted in 1980, heavy metals and explosives were detected on the interior surfaces of buildings and magazines in this area. Lead and chromium were the metals detected at the highest concentrations, with lower concentrations of nickel, cadmium, mercury and silver also detected. Tetryl, HMX, and PETN were the explosives present on building and magazine surfaces above detectable levels.[1] Water samples from sewers which drain the buildings, magazines, and powder wells of the area also contained lead and nickel, indicating some transport of chemicals from the source areas. Tetryl, detected in a single powder well, was the only explosive detected outside of the buildings. Asbestos containing material is believed to exist in the underground tunnel system (as insulating material around pipes) and possibly in and around building spaces (e.g., wall siding).

The extent of contamination at the site is not known. It is possible that soils of the Hanley Area are contaminated with metals and explosives, since dust or water from swept or washed building floors could have been discharged directly to outside soils in the past. (Recent clearing and regrading activities at the site and possible top dressing with fill may have disturbed any existing surface soil contamination.) Off-site soil contamination resulting from surface runoff to areas adjacent to the site is not expected to be significant since drains and sewers of the area likely collect much of the runoff before it leaves the site. It is possible, however, that some soil contamination may exist in adjacent areas if past operations resulted in air emissions and subsequent deposition in these areas. On-site or off-site transport of chemicals in air is not considered likely under current conditions because most of the area is paved and covered by buildings or is vegetated or is currently being reseeded (thereby limiting

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[1] The concentrations of the explosives on interior surfaces are not known since a spot spray technique was used. The spot spray technique only indicates the <u>presence</u> or <u>absence</u> of a chemical above a certain level (4 ug/m^2 for all explosives, in this case).

Encl 3

wind erosional effects) and because most of the chemicals have low volatility. The extent of contamination in the sewer system and its discharge point is not known, although as mentioned above, metals were detected in the sewer system of the Hanley Area. Off-site contamination resulting from the discharge or overflow from the sewer system is therefore possible. Chemicals from the site also could discharge to groundwater as a result of infiltration from contaminated sewers, powder wells, or surface soils.

The Hanley Area is not currently used and is fenced with barbed wire to prevent public access. Therefore no on-site human exposures are expected to occur. However, it is possible that persons could gain access to the site through unsecured underground tunnels. These tunnels are expected to be closed off in the future, thereby preventing underground access to the site and possible on-site exposures. Because significant off-site transport of chemicals in soil or air is not expected, no off-site exposures to chemicals in these media are expected to occur, including no expected exposures in the Job Corps Training Center located immediately west and adjacent to the site. The potential for off-site exposure to chemicals in surface water or groundwater is not known and cannot be inferred based on the currently available data.

Human exposures could occur, however, if the Hanley Area was reopened and the buildings were used. The primary exposure pathway under this scenario would be direct contact with contaminated building surfaces and/or surface soil (if chemicals are present in the soil). Inhalation of dust generated inside the buildings is possible, but the exposure levels are expected to be much less than those associated with direct contact. No contact with any chemicals present in the sewers or powder wells would be expected to occur.

The magnitude of exposure would depend somewhat upon the uses of the buildings, but no activities are anticipated to result in extensive or frequent contact with building surfaces (e.g., walls, floors, drains, window sills, etc.). Direct contact with building surfaces could result in incidental ingestion and/or dermal absorption of chemicals. Incidental ingestion results from contact of the contaminated skin (for example on the hands) with the mouth during activities such as eating or smoking. Dermal absorption results when chemicals in contact with the skin penetrate through the skin and enter the blood stream. Generally, the dermal absorption pathway is important only for organic chemicals, which are able to penetrate skin; dermal absorption of metals is considered negligible.

To provide a preliminary indication of the potential risks associated with direct contact with chemicals in the buildings of the Hanley Area, potential exposures to some chemicals can be quantified using data collected during the 1980 sampling activities (as reported in USATHAMA 1981). A quantitative evaluation of exposure to the organic chemicals (explosives) detected at the site is not possible because, as discussed previously, the concentrations of the explosives in the interior surfaces of the buildings are not known. Quantitative data are available for inorganic chemicals. Of the inorganic chemicals detected, lead was present at the highest concentrations and also is the most toxic of the inorganic chemicals detected. Therefore, based on the available data, risks associated with exposure to lead will be greater than those associated with exposures to other inorganic chemicals detected at the site and can be used to provide a preliminary upperbound estimate of risks associated with direct contact with building surfaces.

Lead was detected on the building surfaces in the Hanley Area at an average concentration of 6 mg/m^2 and at a maximum concentration of 27 mg/m^2; the average and maximum concentrations in the three buildings proposed by the Army for immediate use[2] as warehouses (buildings 219A, 219D, and 219G) were 1.4 mg/m^2 and 1.9 mg/m^2, respectively (USATHAMA 1981). Risks associated with direct contact of lead at the maximum and average detected concentrations across the site are calculated to provide a range of possible risks at the site; risks associated with direct contact at the average and maximum concentration in the three buildings proposed for use as warehouses are calculated to provide an indication of potential risks associated with use of these buildings before remedial activities have been concluded.

To calculate potential worker exposures to these lead concentrations, it is assumed that a 70 kg (154 lb) worker does not wear gloves and could contact a contaminated surface once a week, 50 weeks each year, for a total of 50 exposure events each year. The area of contact is assumed to be 0.05 m^2, which is the median surface area of one side of a man's hands (calculated from EPA 1985). It also is assumed that 1) with each contact, the chemical present on the surface is completely removed from the surface to the person's hand, 2) a person contacts a different contaminated surface area each time (but with the same lead concentration), and 3) that all lead on the surface of the hand is incidentally ingested.

Using these assumptions, daily human intakes are calculated for the maximum and average lead concentrations in all buildings across the Hanley Area (27 mg/m^2 and 6 mg/m^2, respectively) and average and maximum lead concentrations in the three buildings of the Hanley Area proposed for use as warehouses (1.4 mg/m^2 and 1.9 mg/m^2). The resultant estimates of daily intake are as follows:

- 2.7×10^{-3} mg lead/kg-day (maximum for all buildings in Hanley Area);
- 6.0×10^{-4} mg lead/kg-day (average for all buildings in Hanley Area);
- 1.4×10^{-4} mg lead/kg-day (average for three buildings in Hanley Area proposed for use as warehouses); and
- 1.8×10^{-4} mg lead/kg-day (maximum for three buildings in Hanley Area proposed for use as warehouses).

Risks are estimated by comparing the estimated daily intakes with a toxicity reference dose (RfD). The RfD, expressed in units of mg/kg-day, is an estimate of the daily exposure to the human population (including sensitive subpopulations) that is likely to be without an appreciable risk of deleterious effects during a lifetime. Currently, EPA has not developed an oral RfD for lead. However, for the purposes of this preliminary evaluation,

[2] That is, before the RI is completed.

a provisional RfD of 6.0×10^{-4} mg/kg-day is developed based on a previously proposed health-based drinking water standard (see Appendix).

If the estimated daily intake exceeds the RfD (i.e., if the ratio is greater than 1), then exposures may be associated with health risks (although absolute conclusions cannot be drawn, given the uncertainties associated with the RfD and the exposure estimates). The ratios of estimated intake to RfD for exposure to lead on the building surfaces are as follows:

- <u>greater than 1</u> for the maximum exposure across the Hanley Area;

- <u>equal to 1</u> for the average exposure across the Hanley Area;

- <u>less than 1</u> (0.2) for the average exposure across the three buildings proposed for use as warehouses; and

- <u>less than 1</u> (0.6) for the maximum exposure in the three buildings proposed for use as warehouses.

Thus, potential exposures to the maximum lead concentration in the Hanley Area buildings may be associated with adverse health effects, whereas, potential exposures associated with the average and maximum concentrations in the proposed warehouses may not be associated with adverse health effects. Exposures to the average lead concentration across the Hanley Area is associated with an intake: RfD ratio equal to 1, suggesting that average exposures may not be associated with adverse health effects. However, exposures to the other chemicals present at the site would add to total exposure, potentially resulting in greater risks under the average case and the two maximum cases evaluated.

All estimates of risks presented above should be regarded as preliminary given the limited sampling data upon which they are based. More data are needed on the distribution and extent of chemical contamination in the buildings in the Hanley Area.

No potential impacts on environmental receptors are expected to be associated with the contamination in the Hanley Area, primarily because this area has very limited value as wildlife habitat (e.g., paved areas, buildings) and is likely to support few species. Some wildlife (primarily birds such as robins, pigeons, mourning doves, that are common to urban areas) may use the site occasionally but are unlikely to be significantly exposed to chemicals present inside the buildings, although some minimal and infrequent exposure could be possible. No pathways exist by which wildlife could be exposed to chemicals in the sewers or powder wells. Off-site exposure of wildlife to chemicals that have been discharged from the sewer system to surface water, sediment, or soil is possible but cannot be evaluated currently since no data are available.

ATTACHMENT A

TOXICITY OF LEAD

Absorption of lead from the gastrointestinal tract of adult humans is estimated to range from 8 to 45 percent. In children, absorption from non-paint sources ranges from 30 percent to 50 percent (Hammond 1982, EPA 1986). Other interpretations of the data (Duggan 1983) suggest that non-paint lead absorption may be as high as 70 percent. For adult humans, the deposition rate of particulate airborne lead is 30 percent to 50 percent, and essentially all of the lead deposited is absorbed. Lead is stored in the body in bone, kidney, and liver (EPA 1984). The major adverse health effects in humans caused by lead include alterations in the hematopoietic and nervous systems. The toxic effects are generally related to the concentration of this metal in blood. Blood concentration levels of over 80 ug/dl in children and over 100 ug/dl in sensitive adults can cause severe, irreversible brain damage, encephalopathy, and possible death. The Centers for Disease Control (CDC 1985) have used the value of 25 ug/dl as an acceptable level of blood lead. Recent information, however (EPA 1988a), indicates that physiological and/or biochemical effects can occur at even lower levels. These include enzyme inhibition (16 ug/dL), elevated erythrocyte protoporphyrin (15 ug/dL), interference with Vitamin D metabolism, cognitive dysfunction in infants (10 to 15 ug/dL), electrophysiological dysfunction (6 ug/dL), and reduced childhood growth (4 ug/dL). Decreased fertility, fetotoxic effects, and skeletal malformations have been observed in experimental animals exposed to lead (EPA 1984).

Oral ingestion of certain lead salts (lead acetate, lead phosphate, lead subacetate) has been associated in experimental animals with increased renal tumors. Doses of lead that induced kidney tumors were high and were beyond the lethal dose in humans (EPA 1985). EPA classified certain lead salts in Group B2--Probable Human Carcinogen (EPA 1985), although no cancer potency factor has been established (EPA 1988b). EPA (1988a) has recently proposed a maximum contaminant level goal (MCLG) of zero for lead and considers it inappropriate to develop a reference dose for inorganic lead and lead compounds since many of the health effects associated with lead intake may occur essentially without a threshold. For purposes of this preliminary assessment, a provisional oral RfD of 6.0×10^{-4} mg/kg-day has been calculated from the previously proposed MCLG of 0.02 mg/liter, assuming consumption of 2 liters of water per day by a 70 kg individual for a lifetime. This value is used to assess oral exposures for the purposes of this preliminary assessment only and should not be construed to represent a verified RfD which has undergone EPA peer-review.

REFERENCES FOR ATTACHMENT A

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